

PRINTER AND PRINTING METHOD

Inventor: Minoru Horii

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

5 This present invention relates to a printer and a printing method, and more particularly, is suitably applied to a printer and a printing method for printing a color image based on input print data on a printing medium.

DESCRIPTION OF THE RELATED ART

10 This type of printer can perform image adjustment processing, such as color adjustment and lightness adjustment, on a color image based on print data, which is supplied from a personal computer in accordance with operations by an operator, by applying predetermined signal processing to the print data.

15 In actual, in the case where, for example, the color adjustment out of the above described image adjustment processing is performed, this printer can fine-adjust the tint of a color image by changing levels of primary color signals for red (R), green (G), and blue (B) forming print data, in accordance with the adjustment by an operator.

20 In general, rising signal levels of three primary colors has a characteristic that colors (red, green, blue) shown by primary color signals are emphasized, and lowering the signal levels has a characteristic that complementary colors (cyan, magenta, yellow) of colors shown by the primary color signals are emphasized.

25 However, for an operator who adjusts a color image based on print data to a desired tint different from the present tint in the above described color adjustment, it is difficult to determine which color should be selected among three primary colors and further, how much a signal level of a selected color should be changed. Therefore, the operator actually adjusts the present tint to a desired tint by his intuition.

09517149 030200

Sub
A1

As one method of solving the above described problems, a printer is proposed which is configured so that whenever the image adjustment processing are updated in accordance with operations by an operator, the updated image adjustment is reflected on a color image and the reflected result can be output as a video signal to a monitor which is connected as an external unit. Thereby, the operator can perform the above described image adjustment processing while visually confirming a color image based on the video signal displayed on the monitor.

Since a method of mixing colors using the additive process is applied to the above described color image based on a video signal displayed on a monitor and a method of mixing colors using the subtractive process is applied to a color image actually printed on a printing medium, a tint of a color image subjected to image adjustment processing may slightly differ between the case where the color image is displayed on a monitor and the case where the color image is actually printed on a printing medium.

For example, since the Japanese skin color is comprised of red, green, and blue with a higher ratio in this order among three primary colors, raising a blue signal level actually makes the skin color pinkish, not bluish, and lowering a red signal level actually makes the skin color yellowish and whitish, not cyanic (light bluish). This is the reason why the color adjustment processing is very difficult.

An operator purposes obtaining a printing medium having a color image printed thereon, and a color image actually printed on the printing medium frequently has a tint different from a tint desired by the operator even if the above described color adjustment processing is performed on the basis of a color image displayed on a monitor. In this case, it is necessary to repeat the above described color adjustment processing many times until the tint desired by the operator is obtained and further, the operator has to print the color image whenever the color adjustment is performed, in order to visually confirm the tint. As a result, problems occur that the printing medium is wasted and the time also wastefully elapses.

SUMMARY OF THE INVENTION

In view of the foregoing, an object of this invention is to provide a printer, printing method, and printing medium capable of significantly improving the printing efficiency.

5 The foregoing object and other objects of the invention have been achieved by the provision of a printer for printing a first image based on supplied first print data on a printing medium. The printer comprises: an image processing means for applying predetermined image processing to first print data; and a printing means for printing the first image based on the first print data subjected to the image processing, on the
10 printing medium. The image processing means generates second print data for a frame image which is formed by arranging second images of several kinds obtained by applying image processing different from each other to the first image, in a predetermined arrangement pattern, when a predetermined operation mode is selected, and the printing means prints the frame image based on the second print data on the
15 printing medium.

As a result, the printer allows an operator to easily determine a tendency of the image-quality adjustment according to the image processing of the first image while visually confirming each second image arranged on the basis of the first image in the frame image printed on the printing medium. Thus, the time for obtaining a printing
20 medium in which the image processing is performed in a desired state can be greatly shortened and the printing medium can be avoided in advance from being wasted.

Moreover, the present invention provides a printing method of printing a first image based on supplied first print data on a printing medium, which comprises: a first step of applying predetermined image processing to the first print data; and a second
25 step of printing a first image based on the first print data subjected to the image processing, on a printing medium. When a predetermined mode is selected, in the first step, second print data for a frame image which is formed by arranging second images of several kinds obtained by applying image processing different from each other to the first image, in a predetermined arrangement pattern is generated, and in the second
30 step, a frame image based on the second print data is printed on the printing medium.

As a result, the printing method allows an operator to easily determine a tendency of the image quality adjustment according to the image processing of the first image while visually confirming each second image arranged on the basis of the first image, in the frame image printed on the printing medium. Thus, the time for obtaining a printing medium in which the image processing is performed in a desired state can be greatly shortened and the printing medium can be previously avoided from being wasted.

The nature, principle and utility of the invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings in which like parts are designated by like reference numerals or characters.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a block diagram showing a configuration of a printer of the present embodiment;

Fig. 2 is a flow chart explaining a processing procedure of color-adjustment guide printing according to the present embodiment;

Figs. 3 to 5 are schematic plane views showing a printing medium having a color-adjustment guide image printed thereon; and

Figs. 6 to 8 are schematic plane views each showing a printing medium having a frame image printed thereon, according to another embodiment.

DETAILED DESCRIPTION OF THE EMBODIMENT

Preferred embodiments of this invention will be described with reference to the accompanying drawings:

(1) Configuration of a Printer of This Embodiment

Fig. 1 shows a printer to which the present invention is applied as a whole, and is configured so that when predetermined print data D_p is supplied from a not-illustrated personal computer, a color image based on the print data D_p is adjusted to a

desired tint in accordance with operations by an operator and then, the color-adjusted color image is printed on a predetermined printing medium (not illustrated).

In this printer 1, an operation input unit 2 comprised of a liquid crystal display (LCD) display section 2A and an input key section 2B is connected with a CPU 3, so that an operator can supply various commands to the CPU 3 with the operation input unit 2.

The items of various operations are arranged and displayed on the LCD display section 2A of the operation input unit 2 as display items so that an operator can transmit a command relating to a display item designated out of these display items with the input key section 2B, to the CPU 3. Moreover, the input key section 2B is provided with a printing mode key and a color-adjustment guide mode key (both are not illustrated), so that the CPU 3 can receive an operation mode of the printer 1 designated with these mode designation keys.

Actually, in the printer 1, when the print data D_P is supplied from a personal computer through an interface 4 in the printing mode, the CPU 3 divides the print data D_P into color print data D_{PR} , D_{PG} , and D_{PB} corresponding to colors (R, G, B) and writes them in their corresponding frame memories 5A to 5C every one print image, in accordance with the command C1 supplied from the operator.

Then, the CPU 3 reads the color print data D_{PR} , D_{PG} , and D_{PB} out of the respective frame memories 5A to 5C at predetermined timings and then, transmits them to an image processing section 6.

The image processing section 6 is provided with a color conversion table having a standard printing characteristic for each color, which performs color adjustment correspondingly to an adjustment curve set to each color before and after color adjustment processing and then, executes the processing for isolating unnecessary data (so-called masking). Then, the image processing section 6 applies the density duty time conversion (so-called gamma compensation) to the obtained color print data using a set predetermined heat compensation coefficient and then, transmits the resultant print image data D_{PR1} , D_{PG1} , and D_{PB1} to a printing section 7.

The printing section 7 is configured so as to be able to convert the print image data D_{PR1} , D_{PG1} , and D_{PB1} into current signals, then, supply the current signals to a

parameter values (including the initialization value) which are set and input to the setting items, by the same amount with the input key section 2B.

In this way, the image processing section 6 can generate a color image (hereafter referred to as present set image) based on the print data D_{PR} , D_{PG} , and D_{PB} corresponding to an initialization value under the control of the CPU 3 and moreover, generate color images (hereafter referred to as setting changed images) which are obtained by applying the color adjustment in accordance with the parameter values to the present set image.

Moreover, under the control of the CPU 3, the image processing section 6 reduces the present set image and all the plural setting changed images into a predetermined size, thereafter arranges them in a predetermined arrangement pattern in which the plurality of setting changed images surrounds the present set image, and adds the parameter values under the respectively corresponding present set image and setting changed images, and thereby can generate one frame image (hereafter referred to as color-adjustment guide image), and transmits the color-adjustment guide image to the printing section 7 as print image data D_{PR1} , D_{PG1} , and D_{PB1} .

In this way, the printing section 7 can print a color-adjustment guide image based on the print image data D_{PR1} , D_{PG1} , and D_{PB1} supplied from the image processing section 6 on a printing surface of a predetermined printing medium under the control of the CPU 3. Then, the present set image is displayed in the center of thus obtained printing surface of the printing medium and the plural setting changed images are also displayed in the predetermined arrangement pattern centering the present set image, and moreover the parameter values are displayed under the respectively corresponding present set image and setting changed images.

Thereafter, in accordance with the operations by the operator, the CPU 3 updates and sets the parameter values by the same amount for each color (red, green, blue) with respect to the present set image and the setting changed images in the color-adjustment guide image and then, controls the image processing section 6 and thereby applies the above-described color adjustment processing to the present set image and the setting changed images in accordance with the respective updated parameter values.

As a result, the printing section 7 displays the present set image and the plural setting changed images subjected to the color adjustment in accordance with the updated parameter values, and also displays the updated parameter values under the respectively corresponding present set image and setting changed images.

5 (2) Processing Procedure RT1 of Color-adjustment-guide Printing

When a color-adjustment guide mode is actually selected in accordance with operations by an operator in the printer 1, the CPU 3 starts the processing procedure RT1 of color-adjustment guide printing shown in Fig. 2 in step SP0, and in following step SP1, prints a color-adjustment guide image which is a frame image centering a
10 present set image which is set to an initialization value, on a printing surface of a printing medium.

As shown in Fig. 3, in the color-adjustment guide image F0 printed on the printing surface of the printing medium, a present set image P0 is displayed in the center and plural setting changed images P1 to P6 obtained by applying the color
15 adjustment in plus or minus direction for each color (red, green, blue) to the present set image P0 are displayed so as to surrounding the present set image P0.

In this case, a parameter value set to the present set image P0 is equal to an initialization value (0, 0, 0) and parameter values set to the setting changed images P1 to P6 are equal to (+3, 0, 0), (-3, 0, 0), (0, +3, 0), (0, -3, 0), (0, 0, +3) and (0, 0, -3)
20 respectively obtained by adding 3 in the plus direction or the minus direction for each color.

Then, the CPU 3 proceeds to step SP2 to judge whether the present set image P0 has a tint desired by an operator or not and then, directly proceeds to step SP5 when an affirmative result is obtained to complete the processing procedure RT1 of the color-
25 adjustment guide printing.

On the contrary, obtaining a negative result in step SP2 represents that the present set image P0 has a tint not desired by the operator. In this case, the CPU 3 proceeds to step SP3 to update the parameter value of the present set image P0 on the base of tints of the setting changed images P1 to P6.

30 For example, when the operator desires a gray background and visually confirms that the setting changed image P2 has a background color closest to the

desired gray among the setting changed images P1 to P6 and its red color should be slightly suppressed, the CPU 3 updates the parameter value of the present set image P0 to (-4, 0, 0) so as to slightly further suppress the red color of the parameter value (-3, 0, 0) of the setting changed image P2.

5 As a result, as shown in Fig. 4, in a color-adjustment guide image F1, a parameter value set to the present set image P0 becomes equal to (-4, 0, 0), and parameter values set to the setting changed images P1 to P6 respectively become equal to (-1, 0, 0), (-7, 0, 0), (-4, +3, 0), (-4, -3, 0), (-4, 0, +3), and (-4, 0, -3), respectively, by adding ± 3 to each color (red, green blue) of the setting value of the present set image
10 P0.

Then, the CPU 3 proceeds to step SP4 to execute printing using the updated parameter value and then, returns to step SP2 to judge whether the present set image printed on the printing medium has a tint desired by the operator or not.

When an affirmative result is obtained in step SP2, the CPU 3 directly advances
15 to step SP5 to complete the processing procedure RT1 of color-adjustment guide printing.

To the contrary, obtaining a negative result in step SP2 represents that the operator does not obtain a desired tint yet although the parameter value is updated. In this case, the CPU 3 repeats the processing of steps SP3, SP4, and SP2 until the present
20 set image has the desired tint.

Specifically, as for the color-adjustment guide image F1 shown in Fig. 4, the operator visually confirms that a color of a background image closest to desired gray is neutral of the present set image P0 and the setting changed images P2 and P3 out of the plural setting changed images P1 to P6, the operator updates the parameter value of the
25 present set image P0 to (-5, 0, +2) by obtaining a neutral tint of the parameter value (-4, 0, 0) of the present set image P0, the parameter value (-4, 0, +3) of the setting changed image P2, and the parameter value (-7, 0, 0) of the setting changed image P3.

As a result, as shown in Fig. 5, in a color-adjustment guide image F2, a parameter value set to the present set image P0 becomes equal to (-5, 0, +2), and
30 parameter values set to the setting changed images P1 to P6 respectively become equal to (-2, 0, +2), (-7, 0, +2), (-5, +3, +2), (-5, -3, +2), (-5, 0, +5), and (-5, 0, -1) obtained

by adding ± 3 to each color (red, green, blue) of the setting value of the present set image P0.

As a result, as for the color-adjustment guide image F2 shown in Fig. 5, the setting changed image P3 is visually confirmed out of the present set image P0 and the plurality of setting changed images P1 to P6, as one which has the background image closest to desired gray and the optimum portrait color.

(3) Operations and Advantages of This Embodiment

In the above described configuration, the printer 1 generates plural setting changed images obtained by applying the color adjustment using a predetermined parameter value for each color (red, green, blue) to a present set image based on print data D_p , in the color-adjustment guide mode. Then, it prints a color-adjustment guide image obtained by arranging the setting changed images in a predetermined arrangement pattern so as to surround the present set image, on a printing medium.

As for the color-adjustment guide image printed on the printing medium, the plural setting changed images arranged around the present set image are color images obtained by changing tints of the present set image in plus or minus direction for each color. Therefore, an operator can easily and visually confirm a state in which tints of setting changed images are changed so as to be successive on the basis of the tint of the present set image.

Moreover, in the color-adjustment guide image printed on a printing medium, parameter values are numerically displayed under the respectively corresponding present set image and plural setting changed images. Therefore, an operator can quantitatively confirm the difference in tints among the present set image and the setting changed image and as a result, he can grasp a degree of color adjustment on the basis of the parameter values.

Then, the operator selects a setting changed image having a tint closest to a desired tint, out of the plural setting changed images, and updates parameter value within a settable range on the basis of a parameter value set to the selected setting changed image. Thereby, a tint of a present set image is adjusted using the updated parameter value.

In this case, tints of the plural setting changed images are also adjusted on the basis of the updated parameter value. Therefore, when printing an obtained color-adjustment guide image on a printing medium, the operator can visually confirm the states of the present set image and setting changed images subjected to the color adjustment.

Thus, whenever the operator updates the parameter value by the above mentioned method, the tint of the present set image is adjusted and the tints of the setting change images arranged around the present set image are also adjusted. Therefore, the operator can easily find the tendency to obtain a desired tint by visually confirming tints of these plural setting changed images. As a result, it is possible to perform color adjustment in a very short time and with a small number of prints, as compared to a case of printing only a present set image.

According to the above described configuration, in the color-adjustment guide mode, a color-adjustment guide image is generated by arranging the plural setting changed images changed so that tints are successive on the basis of the present set image based on the printing data D_P , around the present set image in a predetermined arrangement pattern. And the color-adjustment guide image is printed on a printing medium. Thereby, an operator can determine a tendency of color adjustment of the present set image while visually confirming the tints of the setting changed image arranged around the present set image. Thus, it is possible to greatly shorten the time required for color adjustment and realize the printer 1 capable of avoiding a printing medium from being wasted.

Moreover, when an operator performs color adjustment of a present set image by updating the present set image while visually confirming a color-adjustment guide image printed on a printing medium by the printer 1, the tint of each setting changed image is also changed in the same adjustment and at the same change rate as the updated present set image. Thereby, whenever the above described update is performed, not only the tint of the present set image but also the tints of the setting changed images become close to a desired tint. Therefore, it is possible to further shorten the time required for color adjustment.

(4) Other Embodiment

0022020" 64727560

Note that, in the above described embodiment, the print data (the first print data) D_P is supplied to the printer 1 from the personal computer. However, the present invention is not restricted to this case and the print data D_P can be supplied from a video recorder. Further, the print data D_P can be reproduced from a recording medium such as a floppy disk, a personal computer (PC) card, a magnetic optical (MO) disk and then supplied to the printer 1.

Moreover, in the above described embodiment, the present invention is applied to the heat-transfer-type printer 1 provided with the printing section (printing means) 7 having the heat-transfer head. However, the present invention is not restricted to the above described case. In short, the present invention can be widely applied to other types of printer (e.g. ink-jet printer and laser printer) as long as the apparatuses are printers to print a present set image (first image) based on supplied print data D_P on a printing medium.

Furthermore, in the above described embodiment, in the color-adjustment guide images (frame images) F0 to F2, the present set image (first image) P0 is arranged in the center and the plural setting changed images (second images) P1 to P6 are arranged centering the present set image P0 in an arrangement pattern. However, the present invention is not restricted to the above described case. Another arrangement pattern can be applied as a arrangement pattern of the setting changed images P1 to P6 as long as an operator can visually confirm the image processing of the setting changed images P1 to P6 on the basis of the present set image P0 to be actually printed. In addition, the number of setting changed images as second images can be optionally set in accordance with an arrangement pattern.

Furthermore, in the above described embodiment, in the color-adjustment guide images (frame images) F0 to F2, parameter values set to the present set image (first image) and plural setting changed images (second images) P1 to P6 are displayed under the respectively corresponding present set image P0 and plural setting changed images P1 to P6. However, the present invention is not restricted to the above described case. The parameter values set as described above can be displayed at any positions in the color-adjustment guide images F0 to F2 as long as an operator can visually confirm that

each parameter value correspond to any of the present set image P0 and the setting changed images P1 to P6.

Furthermore, in the above described embodiment, the operation input unit 2 of the printer 1 is utilized to select a color-adjustment guide mode (predetermined operation mode), input various parameter values or the like. However, the present invention is not restricted to the above described case. An input section (including a keyboard and a mouse) of an externally-connected personal computer (not illustrated) can be used instead of the operation input unit 2. Further, it is also possible to generate the present set image and the setting changed images and form a frame image in which parameters are also displayed, with the externally-connected personal computer (not illustrated), and to print the frame image with the printer 1.

Furthermore, in the above described embodiment, the image processing section 6 provided in the printer 1 is used as an image processing means for applying predetermined image processing to the supplied print data (first print data) D_P. In short, the present invention can be widely applied to various types of image processing means such as a personal computer, as long as it is possible to generate the print image data (second print data) D_{PR1}, D_{PG1}, and D_{PB1} for the color-adjustment guide images (frame images) F0 to F2 obtained by arranging the plural setting changed images (second images) P1 to P6 obtained by applying the color-adjustments (image-processing) different from each other to the present set image (first image) P0, in a predetermined arrangement pattern when a color-adjustment guide mode (predetermined operation mode) is selected.

Further, as the image processing to be applied to the print data D_P in the image processing section (image processing means) 6, image processing having image-quality adjusting functions such as lightness adjustment, masking, γ compensation, enlargement/reduction, sharpness adjustment, or trimming, can be utilized, other than the color adjustment.

In this case, when a predetermined operation mode is selected, processing corresponding to image processing having the selected image quality adjusting function is performed. Note that, in a printer which does not perform color adjustment

processing, a present set image (first image) based on supplied image data D_p can be a black-and-white image, not a color image.

For example, as shown in Fig. 6, when an operation mode corresponding to lightness adjustment processing is selected, parameter values on the basis of a brightness-signal level of the print data D_p is set to the present set image (first image) P10 and the setting changed images (second images) P11 and P12. When assuming that the present set image P10 has normal brightness (parameter value "0"), an advantage that the printing efficiency is greatly improved is obtained similarly to the case of this embodiment, by printing a lightness-adjustment guide image F3 in which the setting changed image P11 having a high brightness (parameter value "+7") is displayed at the right side and the setting changed image P12 (parameter value "-7") having a low brightness is displayed at the left side on the basis of the present set image P10, on a printing medium.

Moreover, as shown in Fig. 7, when an operation mode corresponding to enlargement/reduction processing is selected, parameter values on the basis of the size of a frame image based on the print data D_p is set to a present set image (first image) P20 and setting changed images (second images) P21 and P22. When assuming that the present set image P20 has a normal size (parameter value "100"), an advantage that the printing efficiency is greatly improved is obtained similarly to the case of this embodiment, by printing an enlargement/reduction guide image F4 in which the enlarged (parameter value "141") setting changed image P21 is displayed at the right side and the reduced (parameter value "70") setting changed image P22 is displayed at the left side on the basis of the present set image P20, on a printing medium.

Furthermore, as shown in Fig. 8, when an operation mode corresponding to sharpness processing is selected, parameter values on the basis of the sharpness of the outline of a frame image based on the print data D_p is set to a present set image (first image) P30 and setting changed images (second images) P31 and P32. When assuming that the present set image P30 is a standard (parameter value "0"), it is possible to obtain an advantage that the printing efficiency is greatly improved similarly to the case of this embodiment, by printing a sharpness guide image F5 in which the setting changed image P31 having a emphasized outline (parameter value "+7") is displayed at

002020-6472560

the right side and the setting changed image P32 having a fuzzy outline (parameter value "-7") is displayed at the left side on the basis of the present set image P30, on a printing medium.

As described above, according to the present invention, a printer for printing a first image based on supplied first print data on a printing medium comprises: an image processing means for applying predetermined image processing to the first print data; and a printing means for printing a first image based on the first print data subjected to the image processing, on the printing medium. When a predetermined operation mode is selected, the image processing means generates second print data for a frame image formed by arranging second images of several kinds obtained by applying image processing different from each other to the first image, in a predetermined arrangement pattern, and the printing means prints the frame image based on the second print data on the printing medium. Thereby, it is possible to greatly shorten the time for obtaining a printing medium to which the image processing is applied in a desired state and to avoid the printing medium from being wasted. Thus, it is possible to realize a printer capable of greatly improving the printing efficiency.

Moreover, according to the present invention, a printing method for printing a first image based on supplied first print data on a printing medium, comprises: the first step of applying predetermined image processing to the first print data; and the second step of printing a first image based on the first print data subjected to the image processing, on the printing medium. When a predetermined operation mode is selected, in the first step, second print data for a frame image formed by arranging second images of several kinds obtained by applying image processing different from each other to the first image, in a predetermined arrangement pattern is generated, and in the second step, a frame image based on the second image data is printed on the printing medium. Thereby, it is possible to greatly shorten the time for obtaining a printing medium to which the image processing is applied in a desired state and to avoid the printing medium from being wasted. Thus, it is possible to realize a printing method capable of greatly improving the printing efficiency.

While there has been described in connection with the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and

modifications may be aimed, therefore, to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of the invention.

002060" 647 7560